

3D CONVERSATIONS IN AN ARTIFICIAL REALITY ENVIRONMENT

TECHNICAL FIELD

[0001] The present disclosure is directed to aspects of a communication pipeline between multiple devices for implementing three-dimensional (“3D”) conversations.

BACKGROUND

[0002] Video conferencing has become a major way people connect. From work calls to virtual happy hours, webinars to online theater, people feel more connected when they can see other participants, bringing them closer to an in-person experience. Such video calls, however, remain a pale imitation of face-to-face interactions. Understanding body language and context can be difficult with only a two-dimensional (“2D”) representation of a sender. Further, communication often relies on interpersonal interactions, such as spatial movements between participants. Yet communication over video calling does not provide the ability for participants to move relative to each other, as the point of view is fixed to the sender’s camera. In addition, the limitation of video calling on a flat panel display introduces an intrusive layer of technology that can distract from communication and diminishes the perception of in-person communication.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] FIG. 1 is a block diagram illustrating an overview of devices on which some implementations of the present technology can operate.

[0004] FIG. 2A is a wire diagram illustrating a virtual reality headset which can be used in some implementations of the present technology.

[0005] FIG. 2B is a wire diagram illustrating a mixed reality headset which can be used in some implementations of the present technology.

[0006] FIG. 3 is a block diagram illustrating an overview of an environment in which some implementations of the present technology can operate.

[0007] FIG. 4 is a block diagram illustrating components which, in some implementations, can be used in a system employing the disclosed technology.

[0008] FIG. 5 is a flow diagram illustrating a process used in some implementations of the present technology for a 3D conversation between two or more devices.

[0009] FIG. 6 illustrates variations on the flow diagram from FIG. 5 used in some implementations of the present technology where stages are performed at various systems.

[0010] FIG. 7 is a flow diagram illustrating a process used in some implementations of the present technology for a calibration stage of a 3D conversation pipeline.

[0011] FIG. 8 is a flow diagram illustrating a process used in some implementations of the present technology for a capture stage of a 3D conversation pipeline.

[0012] FIG. 9 is a flow diagram illustrating a process used in some implementations of the present technology for a filter and tag stage of a 3D conversation pipeline.

[0013] FIG. 10 is a flow diagram illustrating a process used in some implementations of the present technology for a compression stage of a 3D conversation pipeline.

[0014] FIG. 11 is a flow diagram illustrating a process used in some implementations of the present technology for a decompression stage of a 3D conversation pipeline.

[0015] FIG. 12 is a flow diagram illustrating a process used in some implementations of the present technology for a reconstruction stage of a 3D conversation pipeline.

[0016] FIG. 13 is a flow diagram illustrating a process used in some implementations of the present technology for a render stage of a 3D conversation pipeline.

[0017] FIG. 14 is a flow diagram illustrating a process used in some implementations of the present technology for a display stage of a 3D conversation pipeline.

[0018] FIG. 15A is a conceptual diagram illustrating an example 3D conversation from a first system perspective in an artificial reality environment.

[0019] FIG. 15B is a conceptual diagram illustrating the example 3D conversation of FIG. 15A, from a second system perspective in an artificial reality environment.

[0020] The techniques introduced here may be better understood by referring to the following Detailed Description in conjunction with the accompanying drawings, in which like reference numerals indicate identical or functionally similar elements.

DETAILED DESCRIPTION

[0021] Aspects of the present disclosure are directed to 3D conversations in an augmented reality environment, allowing users to have a conversation while appearing as if they are face-to-face in 3D space. A 3D conversation system can accomplish this by implementing a pipeline of data processing stages, which can include one or more of the following: calibrate, capture, tag and filter, compress, decompress, reconstruct, render, and display. Generally, the pipeline can capture images of the user of a first device (a “sending user”), create intermediate representations, transform the representations to convert from the orientation the images were taken from to a viewpoint of a user of a second device (a “receiving user”), and output images of the sending user from the viewpoint of the receiving user. In some implementations, this pipeline can be performed, for example, with a 100 ms latency or less.

[0022] A 3D conversation can take place between two or more sender/receiving systems and, in some implementations, can be mediated by one or more server systems. In various configurations, stages of the pipeline can be performed on different ones of these systems and/or stages can be dynamically performed on different systems based on a “conversation context”. A conversation context can include any available contextual information of the conversation such as available resources (sender and/or receiver processing capacity, bandwidth, a remaining battery level, etc.), capture and/or display capabilities of the sender and/or receiver, user settings, receiver viewpoint, sender camera positions, etc.

[0023] The capture stage can include the capture of audio, traditional images, and/or depth data by one or more capture devices of a sender 3D conversation system. In various implementations, the captured depth data can include distance data (i.e., for each pixel, the distance between the lens and the object depicted in that pixel, e.g., in a depth image), a point cloud (i.e., a set of points defined in 3D space), a light field (i.e., one or more vectors that describe the amount of light flowing in various directions for various points in space), or another depiction of 3D space. In various imple-